

## IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: Hardayal Singh Gill

Application No.: 10/777,647

Group No.: 2627

Filed: February 11, 2004

Examiner: BLOUIN, Mark S.

For: SELF-PINNED DOUBLE TUNNEL JUNCTION HEAD

Commissioner for Patents

P.O. Box 1450

Alexandria, VA 22313-1450

DECLARATION OF PRIOR INVENTION IN THE UNITED STATES  
OR IN A NAFTA OR WTO MEMBER COUNTRY  
TO OVERCOME CITED PATENT OR PUBLICATION (37 C.F.R. § 1.131)

## PURPOSE OF DECLARATION

1. This declaration is to establish completion of the invention of claims 1-3, 8, 10-12, 15, and 18 of this application in the United States at a date prior to December 11, 2003, that is the effective date of the prior art publication that was cited by the Examiner.
2. The person making this declaration is the inventor.

## CERTIFICATION UNDER 37 C.F.R. §§ 1.8(a) and 1.10\*

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Express Mail certification is optional.)

I hereby certify that, on the date shown below, this correspondence is being:

## MAILING

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37 C.F.R. § 1.8(a)

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37 C.F.R. § 1.10\*

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## TRANSMISSION

, facsimile transmitted to the Patent and Trademark Office, (703) \_\_\_\_\_.

Signature \_\_\_\_\_

Date: \_\_\_\_\_

(Type or print name of person certifying)

\* Only the date of filing (§ 1.6) will be the date used in a patent term adjustment calculation, although the date on any certificate of mailing or transmission under § 1.8 continues to be taken into account in determining timeliness. See § 1.102(b). Consider "Express Mail Post Office to Addressee" (§ 1.10) or facsimile transmission (§ 1.6(d)) for the reply to be accorded the earliest possible filing date for patent term adjustment calculations.



### FACTS AND DOCUMENTARY EVIDENCE

3. As evidence of the date of conception of the invention of this application, the following attached documents and/or models are submitted as evidence:

STATEMENT: I hereby state that conception of the invention of claims 1-3, 8, 10-12, 15, and 18 in the above-identified patent application was made prior to September 8, 2003, as supported by Exhibits A and B. Exhibit A, dated September 8, 2003, shows the pertinent portions of a disclosure by the inventor. Exhibit B, dated September 8, 2003, shows technical notes disclosing the pertinent portions of the invention by the inventor. I state that the concepts and features described in Exhibits A and B were conceived, and documented by the inventor prior to December 11, 2003.

EXHIBIT A: Copy of pertinent portions of a disclosure dated September 8, 2003.

Exhibit A demonstrates that the subject matter of claims 1-3, 8, 10-12, 15, and 18 were in the inventor's possession at least as early as September 8, 2003 as described below.

Page 2 of disclosure, Summary of Invention, discloses claims 1-3, 8, 10-12, 15, and 18:

CoFe/Ru/CoFe (AP Pinned Layer Structure) - Cu (Barrier Layer) - CoFe/NiFe/CoFe (Free Layer) - Cu (Barrier Layer) - CoFe/Ru/CoFe (AP Pinned Layer Structure).

EXHIBIT B: Copy of pertinent portions of the inventor's technical notes dated September 8, 2003.

Exhibit B demonstrates that the subject matter of claims 1-3, 8, 10-12, 15, and 18 were in the inventor's possession at least as early as September 8, 2003 as described below.

Page 1 of the inventor's notes, bottom of the page, discloses claims 1-3, 8, 10-12, 15, and 18:

CoFe/Ru/CoFe (AP Pinned Layer Structure) - AlOx (Dielectric Barrier Layer) - CoFe/NiFe/CoFe (Free Layer) - AlOx (Dielectric Barrier Layer) - CoFe/Ru/CoFe (AP Pinned Layer Structure).

#### With respect to claim 1:

A dual magnetic tunnel junction head (Exhibit A - Page 2 of disclosure, Summary of Invention, Exhibit B - Bottom of page "Double Tunnel Junction"),

a free layer (Exhibits A and B - CoFe/NiFe/CoFe);

first and second antiparallel (AP) pinned layer structures positioned on opposite sides of the free layer (Exhibits A and B - CoFe/Ru/CoFe (AP Pinned Layer Structure) - CoFe/NiFe/CoFe (free layer) - CoFe/Ru/CoFe (AP Pinned Layer Structure));

each of the AP pinned layer structures including at least two pinned layers having magnetic moments that are self-pinned antiparallel to each other, the pinned layers being separated by an AP coupling layer (Exhibits A and B - CoFe (AP pinned layer 1)/Ru(AP coupling layer)/CoFe (AP pinned layer 2));

a first barrier layer formed of a dielectric barrier material and positioned between the first AP pinned layer structure and the free layer (Exhibit A - CoFe/Ru/CoFe (AP Pinned Layer Structure) - Cu (barrier layer - dielectric barrier layer inherent for MTJ to operate) - CoFe/NiFe/CoFe (free layer)); and (Exhibit B - CoFe/Ru/CoFe (AP Pinned Layer Structure) - AlOx (Dielectric Barrier Layer) - CoFe/NiFe/CoFe (Free Layer) - AlOx (Dielectric Barrier Layer) - CoFe/Ru/CoFe (AP Pinned Layer Structure));

a second barrier layer formed of a dielectric barrier material and positioned between the second AP pinned layer structure and the free layer (Exhibit A - CoFe/Ru/CoFe (AP Pinned Layer Structure) - Cu (barrier layer - dielectric barrier layer inherent for MTJ to operate) - CoFe/NiFe/CoFe (free layer)); and (Exhibit B - CoFe/Ru/CoFe (AP Pinned Layer Structure) - AlOx (Dielectric Barrier Layer) - CoFe/NiFe/CoFe (Free Layer) - AlOx (Dielectric Barrier Layer) - CoFe/Ru/CoFe (AP Pinned Layer Structure));

wherein the head does not have an antiferromagnetic layer (Exhibit A - CoFe/Ru/CoFe (AP Pinned Layer Structure) - Cu (barrier layer 1) - CoFe/NiFe/CoFe (free layer) - Cu (barrier layer 2) - CoFe/Ru/CoFe (AP Pinned Layer Structure)); and (Exhibit B - CoFe/Ru/CoFe (AP Pinned Layer Structure) - AlOx (Dielectric Barrier Layer) - CoFe/NiFe/CoFe (Free Layer) - AlOx (Dielectric Barrier Layer) - CoFe/Ru/CoFe (AP Pinned Layer Structure)).

With respect to claim 2:

A head as recited in claim 1, wherein the free layer includes a layer of NiFe (Exhibits A and B - CoFe/NiFe/CoFe (free layer)).

With respect to claim 3:

A head as recited in claim 2, wherein the free layer further includes layers of CoFe sandwiching the layer of NiFe (Exhibits A and B - CoFe/NiFe/CoFe (free layer)).

With respect to claim 8 (as amended):

A head as recited in claim 1, wherein the barrier layers are sufficiently thin such that tunneling of charge carriers occurs between adjacent layers (Exhibits A and B - Inherent in MTJ head using double tunneling junctions).

With respect to claim 10 (as amended):

A dual magnetic tunnel junction head (Exhibit A - Page 2 of disclosure, Summary of Invention, Exhibit B - Bottom of page "Double Tunnel Junction");

a free layer (Exhibits A and B - CoFe/NiFe/CoFe);

first and second antiparallel (AP) pinned layer structures positioned on opposite sides of the free layer (Exhibits A and B - CoFe/Ru/CoFe (AP Pinned Layer Structure) - CoFe/NiFe/CoFe (free layer) - CoFe/Ru/CoFe (AP Pinned Layer Structure));

each of the AP pinned layer structures including at least two pinned layers having magnetic moments that are self-pinned antiparallel to each other, the pinned layers being separated by an AP coupling layer (Exhibits A and B - CoFe (AP pinned layer 1)/Ru (AP coupling layer)/CoFe (AP pinned layer 2));

a first barrier layer formed of a dielectric barrier material and positioned between the first AP pinned layer structure and the free layer (Exhibit A - CoFe/Ru/CoFe (AP Pinned Layer Structure) - Cu (barrier layer - dielectric barrier layer inherent for MTJ to operate) - CoFe/NiFe/CoFe (free layer)); and (Exhibit B - CoFe/Ru/CoFe (AP Pinned Layer Structure) - AlOx (Dielectric Barrier Layer) - CoFe/NiFe/CoFe (Free Layer) - AlOx (Dielectric Barrier Layer) - CoFe/Ru/CoFe (AP Pinned Layer Structure));

a second barrier layer formed of a dielectric barrier material and positioned between the second AP pinned layer structure and the free layer (Exhibit A - CoFe/Ru/CoFe (AP Pinned Layer Structure) - Cu (barrier layer - dielectric barrier layer inherent for MTJ to operate) - CoFe/NiFe/CoFe (free layer)); and (Exhibit B - CoFe/Ru/CoFe (AP Pinned Layer Structure) - AlOx (Dielectric Barrier Layer) - CoFe/NiFe/CoFe (Free Layer) - AlOx (Dielectric Barrier Layer) - CoFe/Ru/CoFe (AP Pinned Layer Structure));

wherein the head is a current perpendicular to plane head (Exhibits A and B - Inherent in MTJ head using double tunneling junctions).

Disclosure of Prior Invention in the United States or in a NAFTA or WTO Member Country to Overcome Cited Patent or Publication—  
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With respect to claim 11:

A head as recited in claim 10, wherein the free layer includes a layer of NiFe (Exhibits A and B - CoFe/NiFe/CoFe (free layer)).

With respect to claim 12:

A head as recited in claim 11, wherein the free layer further includes layers of CoFe sandwiching the layer of NiFe (Exhibits A and B - CoFe/NiFe/CoFe (free layer)).

With respect to claim 15 (as amended):

A head as recited in claim 10, wherein the barrier layers are sufficiently thin such that tunneling of charge carriers occurs between adjacent layers (Exhibits A and B - Inherent in MTJ head using double tunneling junctions).

With respect to claim 18:

A head as recited in claim 10, wherein the head does not have an antiferromagnetic layer (Exhibit A - CoFe/Ru/CoFe (AP Pinned Layer Structure) - Cu (Barrier Layer) - CoFe/NiFe/CoFe (Free Layer) - Cu (Barrier Layer) - CoFe/Ru/CoFe (AP Pinned Layer Structure)); and (Exhibit B - CoFe/Ru/CoFe (AP Pinned Layer Structure) - AlOx (Dielectric Barrier Layer) - CoFe/NiFe/CoFe (Free Layer) - AlOx (Dielectric Barrier Layer) - CoFe/Ru/CoFe (AP Pinned Layer Structure)).

#### **DILIGENCE**

4. It is hereby declared that Applicant acted diligently up to reduction of practice or the filing date of the present patent application.

#### **TIME OF PRESENTATION OF THE DECLARATION**

5. This declaration is submitted prior to final rejection, or with a first or supplementary first reply after a final rejection for the purpose of overcoming a new ground of rejection or requirement made by the examiner, in which case the declaration is considered timely and should be considered. See MPEP 715.09(c).

## DECLARATION

6. As a person signing below:

I hereby declare that the documents attached hereto disclose the subject matter of currently pending claims 1-3, 8, 10-12, 15, and 18 of the subject patent application. I also declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

## SIGNATURE(S)

Typewritten Full Name of  
Sole or First Inventor:

Hardevat Singh Gill

Citizenship: USA

Inventor's signature:

H. S. Gill

Date of Signature:

4/23/07

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## EXHIBIT A

See attached.

Declaration of Prior Invention in the United States or in a NAFTA or WTO Member Country to Overcome Cited Patent or Publication-----  
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**Disclosure HSJ8-2003-0422**

Prepared for and/or by an Hitachi Attorney - Hitachi Confidential

Created By Harry Gill On 09/08/2003 11:18:38 AM PDT

Last Modified By Harry Gill On 09/08/2003 11:47:33 AM PDT

HSJ920030278US1

Required fields are marked with the asterisk (\*) and must be filled in to complete the form.

**\*Title of disclosure (in English)**

SELF-PINNED DOUBLE TUNNEL JUNCTION HEAD

**Summary**

Status	Under Evaluation
Final Deadline	
Final Deadline Reason	
*Processing Location	Hitachi SJO
*Functional Area	Select (Head & Media 02) Design & Integration / Read - Patton/Shiroishi
Attorney/Patent Professional	Ron Feece/US/HGST@HGST
IDT Team	Select Bob Schwenkar/US/HGST Ian McFadyen/US/HGST Lew Munnell/US/HGST Arthur Wai/US/HGST Richard Hsiao/US/HGST Claran Fox/US/HGST Jinshan Liu/US/HGST Tim Minvielle/US/HGST Leslie Reiter/US/Cont/HGST
Submitted Date	09/08/2003 11:26:58 AM PDT
*Owning Division	Select HSJ
Incentive Program	
Lab	
*Technology Code	302
PVT Score	

**Inventors with a Blue Pages entry**

Inventors: Harry Gill/US/HGST

Inventor Name	Inventor Serial	Div/Dept	Phone	Manager Name
> Gill, Harry	565774	HGST/CTM	8-276-2308	Fox, Claran
		A		

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**Inventors without a Blue Pages entry****IDT Selection**

Attorney/Patent Ron Feece/US/HGST@HGST



Professional  
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Jinshan Li/US/HGST@HGST  
Tim Minvielle/US/HGST  
Leslie Reiter/US/Cont/HGST

Response Due to IP&L 10/08/2003

**\*Main Idea**

1. Background: What is the problem solved by your invention? Describe known solutions to this problem (if any). What are the drawbacks of such known solutions, or why is an additional solution required? Cite any relevant technical documents or references.

We disclose a design which allows higher bias voltage for the MTJ head.

2. Summary of Invention: Briefly describe the core idea of your invention (saving the details for questions #3 below). Describe the advantage(s) of using your invention instead of the known solutions described above.

The MTJ head uses double tunneling junctions to improve the  $V_b$  at which the MTJ head begins to fail. The sensor stack is made thinner by the self-pinned top/bot sensors.

seed layers/CoFe/Ru/CoFe/Cu/CoFe/NiFe/CoFe/Cu/CoFe/Ru/CoFe/Cap

## **EXHIBIT B**

See attached.

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Date and sign every entry. Have every possibly impo-  
 entry witnessed. Submit an invention Disclosure of  
 anything possibly new and inventive.

48

=> (V3 Polym) Exp IBM Technical Notebook  
 (V3 TP)  
 (TO DO)

=> Doing stress tests (Kathy)  
 • MT (already reset by Ken)  
 • Varies TP  
 • off time jobs counted  
 • Canceled DDB have Ken counted. A/D

9/8/03 => Long #B transfer across on Co/Co DDB 15 Kde  
 => Reset of PHM-75A (Mat?)

[=> (Disclosures)]  
 => Fails for Friday in 2nd RV  
 (375, 376, 378)

{ => Order Papers from (Diag note) 9/8/03 }

6, 7, 9, 10, 14, | d talbot @ ucshd. el  
 Double Tunnel Junction (Self Pinned)

(Seed | CoFe | Ru | CoFe | AlOx | CoFe | NiO | CoFe | AlOx | CoFe | Ru | CoFe | Cap)

